Annex F
(informative)
Application activity model

Introduction

The application activity model (AAM) is provided as an aid in understanding the scope and information requirements defined in this application protocol. The model is presented as a set of figures that contain the activity diagrams and a set of definitions of the activities and their data. The application activity model is given in figures F.1 through F.11. Activities and data flows that are out of scope are marked with an asterisk.

The AAM covers activities that go beyond the scope of this application protocol. The viewpoint of the application activity model is that of an extended enterprise that potentially consists of multiple organisations and is responsible for the entire system life cycle.

Application activity model arrow labels

The following arrow labels appear in the application activity model. Those labels ending with an asterisk are outside the scope of this application protocol.

The definitions given in this annex do not supersede the definitions given in the main body of the text.

additional model information
Information that is available from some external source to enhance content of a systems engineering model.

Note: Such information will be subject to information management and, thus, along with all other information in the model, originates from the applicable process that is part of project management.

agreement *
Mutual acknowledgement of terms and conditions under which to conduct a working relationship.

agreement feedback *
Feedback that conveys results of activities across an enterprise back to applicable agreement processes.

attribute value
Value that indicates a specific characteristic of the system corresponding to a proposed system model.

authorized engineering change
Change that has received approval for application to one or more technical elements in the creation or operation of a system.

Note: Technical elements can include systems engineering models, design specifications, system or system elements.

authorized project action
Action that is allowable on the basis of an approval in accordance with defined authorities for a project.

behaviour model
Model that represents all functions of the context or subject at a tier of a system and the ordering, inputs and outputs of those functions.

business reality
Commercial factors that include resource availability and influence risk and time to market.

by-product *
Item that arises during production, operation or maintenance of a system and no longer has a useful role to play in the life cycle of the system.

change proposal *
Proposal that identifies the characteristics of a change to some technical element in the creation, operation, maintenance or disposal of a system.

Note: A project team will consider the non-technical implications of a change proposal before authorizing the change to become a reality. The extent and formality of this consideration will depend on the expected impact of the change (in general, impact increases with time during the system life cycle). Organization, enterprise or project policy will specify the criteria on which to assess a change proposal.

chosen solution
Model information that is an optimal specification for a system.

Note: The effectivess measures are the basis for choosing this one solution over other feasible alternatives.

component for integration *
Component that is ready for integration into an emerging system.

component tier model
Set that consists of both the context and subject models specifying a component within a system.

concept tier model
Developed model set that consists of both the context and subject models specifying the concept tier view of a system.

context model set
Set that consists of a behaviour model, structure model and implementation plan for the context of a subject within a tier of a system.

demand on system capability *
Change that occurs to the operational environment of a system and initiates a response from the system.

design for system component *
Specification that provides sufficient descriptive detail to enable the production and testing of a component so as to meet user requirements during operation, maintenance and disposal processes.

developed model set
Set that consists of both a context model and subject model at a tier of a system.

Example: A developed model set can describe:

- user requirements;

- system requirements;

- architectural design.

effectiveness measure
Requirement that is so important as to have a critical impact on the success or failure of a system.

Example: When engineering a laptop computer, two major effectiveness measures (optimization criteria) are typically mass and battery life. The engineer will attempt to minimize mass and maximize battery life.

enabling system *
System that complements the system-of-interest for the purposes of one or more life-cycle processes.

Note: For example, a production enabling system is necessary in order to manufacture and integrate the system.

Each enabling system has a distinct life cycle.

enterprise
Virtual organization that is the result of one or more agreements between two or more organizations and is responsible for the life cycle of a system.

enterprise feedback *
Feedback that conveys the results of project activities to the wider enterprise.

enterprise policy or procedure *
Control that is the basis on which to conduct technical or managerial activity for projects within an enterprise.

Note: An enterprise policy or procedure is complementary to all relevant organization policies or procedures or social, legal or political directives.

existing system or element *
Item that is available from another enterprise for re-use in another system.

feasible solution
Model information that specifies a solution meeting the applicable requirements.

implementation plan
Plan that specifies the order for the build and test of a tier of a system.

information from external source *
Information that arises from any source outside the system enterprise.

initial model set
Model information that is available when beginning the systems engineering modelling process.

Note: In general, the systems engineering modelling process is flexible. Such modelling can be top-down, bottom-up, out-in or middle-out in terms of the sequence of tiers. For simple systems, the difference between the tiers requires a minimum amount of formal project control and an individual engineer can work at more than one tier in parallel.

ISO 15288 *
Systems engineering -- System life cycle processes.

ISO 9001 *
Quality management systems -- Requirements.

map of functions
Set of relationships that each identify the correspondence between a structural element and a behaviour.

model set
Information that consists of all proposed systems engineering models for a particular tier of a system.

modelling database
Information that consists of all in-work systems engineering models to date for a system.

multi-project management aid *
Aid that is available to more than one project within an enterprise and able to support common approaches to management across the enterprise.

organization
Business entity that consists of an interacting collection of personnel, infrastructure and facilities.

Note: For example, an organization can be:

- a company;

- a government department.

organization policy or procedure *
Control that a member organization of a system enterprise applies to business activities and requires the enterprise to take account of.

Note: An organization policy or procedure is complementary to all relevant social, legal or political directives.

other standard *
Standard that is neither ISO 9001 nor ISO 15288 and is available from a statutory standards organization.

Example: The following other standards are relevant to systems engineering:

- EIA 632 "Processes for engineering a system";

- IEEE 1220 "Standard for application and management of the systems engineering process".

project decision *
Choice that establishes the optimum project action against a given set of criteria.

project definition
Definition that embodies the enterprise-level view of a project and is the basis on which members of the enterprise can initiate, execute and continue the project.

Note: A project definition includes:

- project accountabilities and authorities;

- expected outcomes of the project;

- allocated project resources;

- project reporting requirements;

- project review milestones.

project feedback
Feedback that conveys the results of technical activities in a project to the managers of the project.

project policy or procedure *
Control that is the basis on which to conduct technical processes within a project.

Note: A project policy or procedure is complementary to all relevant enterprise or organization policies or procedures or social, legal or political directives.

raw material or consumable *
Item that manufacturing processes will transform to become an integral part of a system.

realized system or sub-system
System or sub-system that is complete and is ready for verification testing.

recycled raw material *
Item that was once either a part of a system or necessary to operate, maintain or dispose of a system and is ready to be raw material in some further process.

register of risk *
Information that identifies and defines risks that are applicable to a project.

rejected system or element
Item that has not met applicable test criteria and requires either corrective action or disposal.

requirements database
Collection of information that describes the basis on which to create a system.

Example: Requirements can include:

- textual descriptions;

- concepts of operations;

- heritage information;

- information about users.

satisfied demand on system capability *
Change that occurs to the operational environment of a system as the result of operation of the system.

set of component requirements
Set that consists of both the behaviour and the structure model for a component within a system.

social, legal or political directive *
Directive that is beyond the direct control of a system enterprise or constituent organizations.

society or organization feedback *
Feedback that connects an enterprise to the broader industrial and social context.

Note: This feedback can include:

- responses to requirements to provide information either to a member organization of an enterprise or to some other external party;

- requests for information from parties external to an enterprise.

specification for existing system or element
Specification that defines the characteristics of an item that is available from another enterprise.

structure model
Model that represents the static structure of the context or subject at a tier of a system.

Note: A structure model is not the same as a structural analysis model that indicates the stress-strain response to a load for a mechanical system or physical component.

sub-system for integration *
Sub-system that is ready for integration into an emerging system.

system assurance evidence
Evidence that supports and validates the predictions of system performance and safety and is the basis on which the acquirer can accept the system as meeting the terms of the applicable enterprise agreement.

system for installation *
System that is verified as complete and is ready for installation in the operational environment.

system for validation *
System that is installed in the operational environment and is ready for validation testing.

system or element for re-use *
Item that is the result of systems engineering and ready for re-use in a system of another enterprise.

system ready for exploitation *
System that is validated and is ready for operation.

technical issue *
Issue that relates to some technical element in the creation, operation, maintenance or disposal of a system.

trade-off result
Result that indicates the basis on which individual potential system or system element solutions meet or fail to satisfy the identified effectiveness measures.

transfer of system responsibility *
Notification that indicates a successful installation of a system in the operational environment and passes responsibility for the system to the intended operator.

waste material *
Item that is in a condition beyond serviceable use.

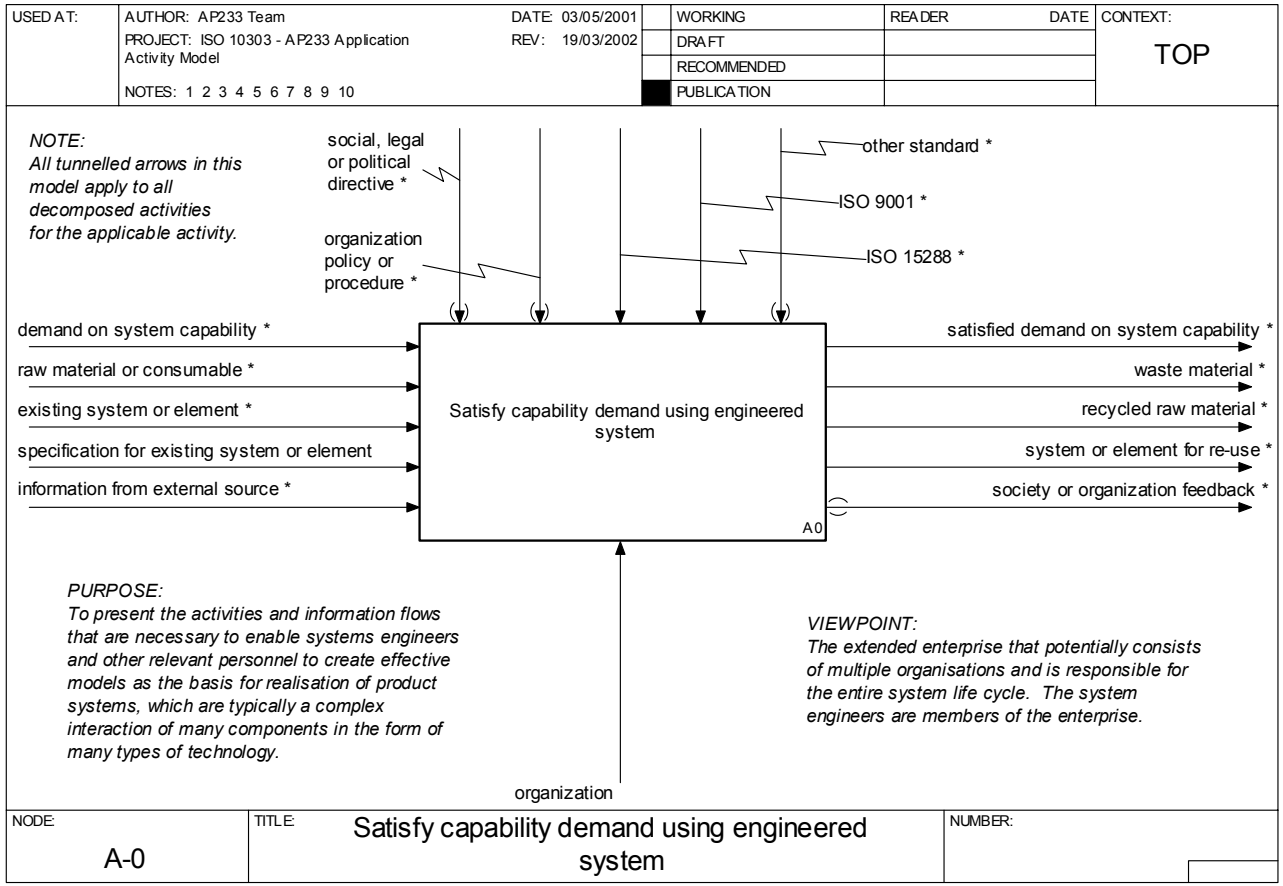

Figure F.1 -- AAM diagram 1 of 11

Satisfy capability demand using engineered system

Bring together organizations to form an extended enterprise to create, operate and dispose of a system that provides a specified capability.

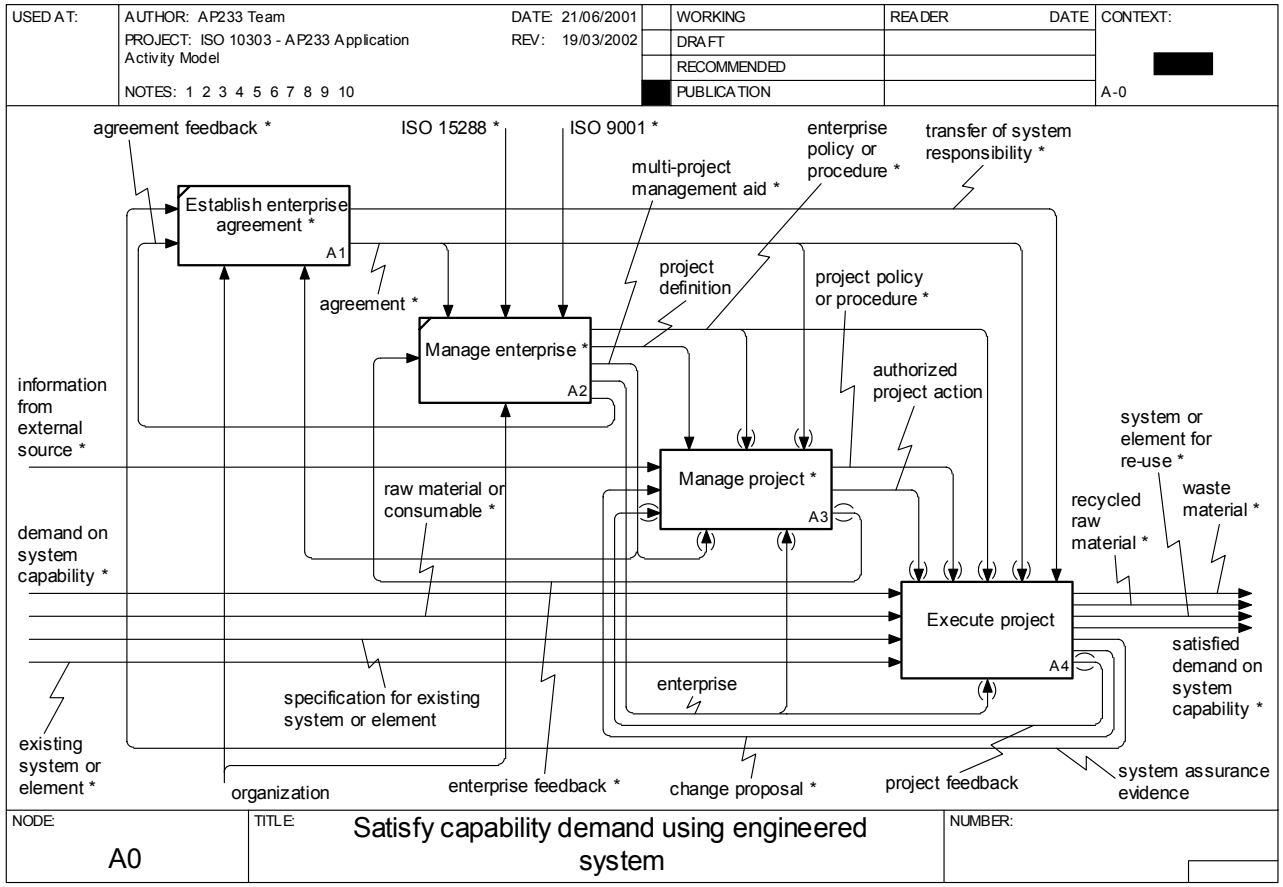

Figure F.2 -- AAM diagram 2 of 11

Establish enterprise agreement *
Achieve an agreement between two organizations, one in the role of acquirer and the other as supplier so as to effect the provision of a product or service.

Manage enterprise *
Establish, operate and maintain the enterprise as the framework by which to initiate, support and monitor projects.

Manage project *
Perform proper planning and control of a project and project-wide factors .
Note: The project-wide factors are risk, configuration and management.

Execute project
Perform the technical processes that mark the successive stages of the system life cycle.

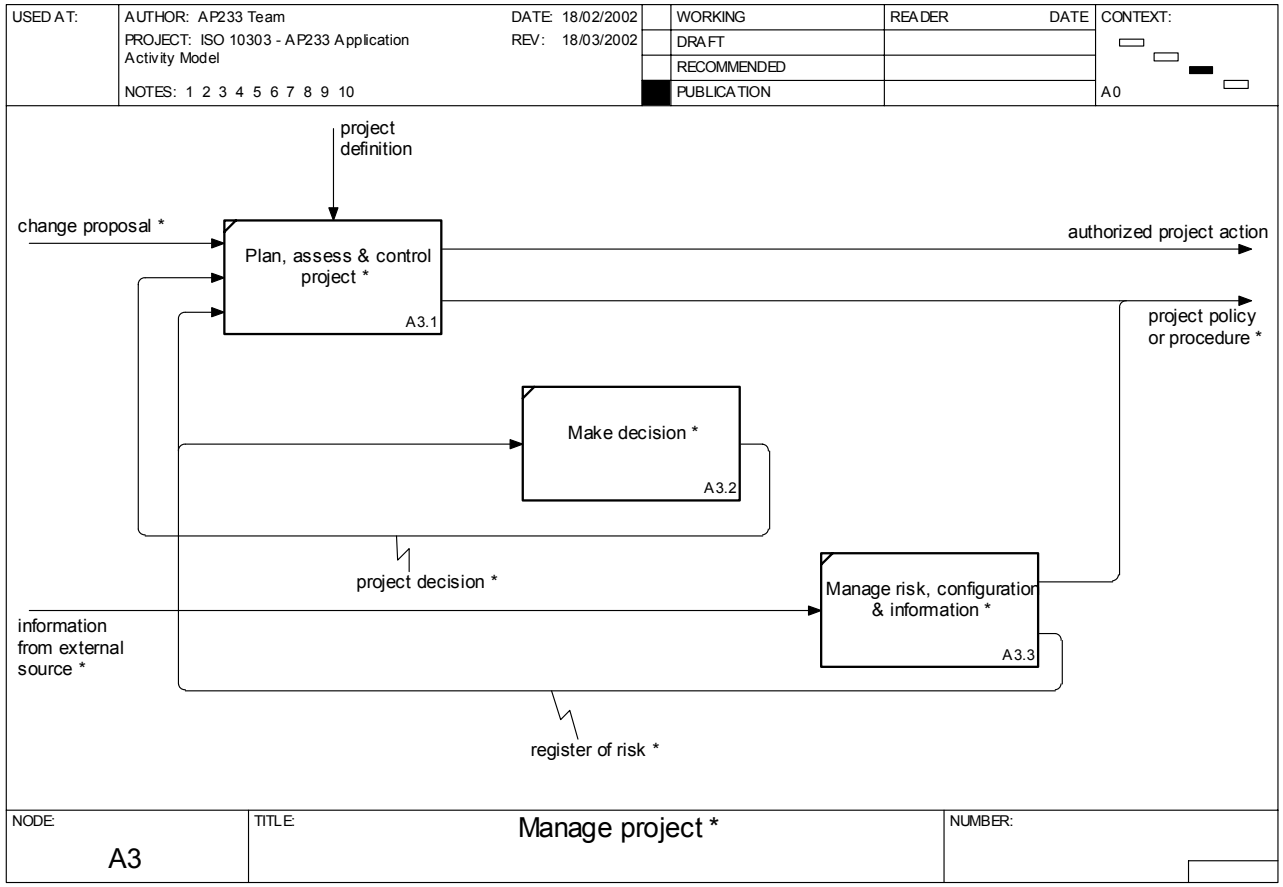

Figure F.3 -- AAM diagram 3 of 11

Plan, assess & control project *
Establish and evolve project plans, assess actual achievement and progress against the plans and control execution of the project through to fulfilment.

Make decision *
Select the most beneficial course of project action where alternatives exist.
Note: Project feedback provides the information by which to recognize the existence of problems and opportunities that lead to a requirement for project decisions.

Manage risk, configuration & information *
Minimize the effects of uncertain events, establish and maintain the integrity of all products of a project and provide relevant, timely, complete valid, confidential information to both the enterprise and external parties.

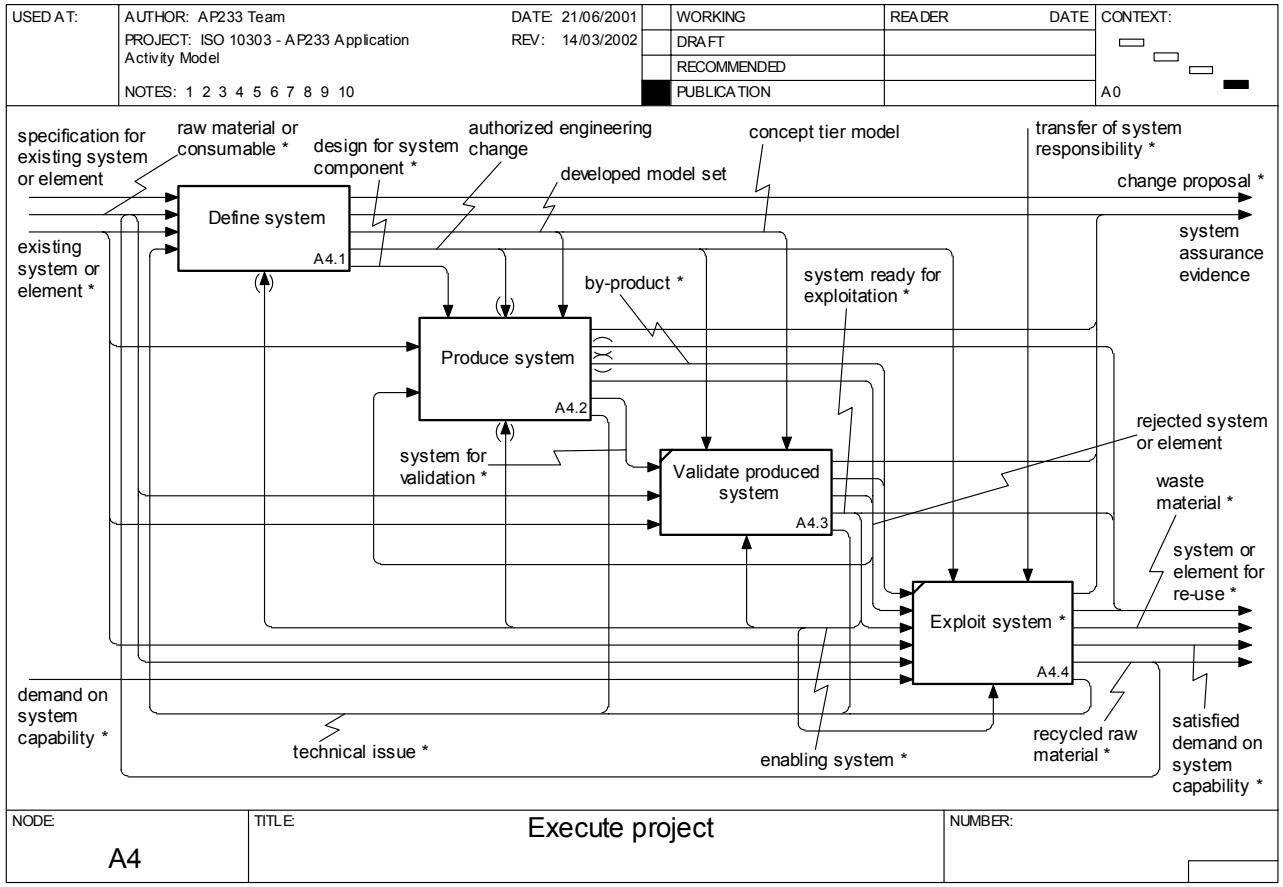

Figure F.4 -- AAM diagram 4 of 11

Define system
Create specifications at successive tiers of the system right down to individual components.

Produce system
Realize and test successive tiers of the system in accordance with the applicable specification.

Validate produced system
Provide objective evidence that the capabilities provided by the system when in use comply with the requirements of the relevant stakeholders.

Exploit system *
Operate, maintain and dispose of the system so as to fulfil the demands on the system capability for the agreed service life of the system.

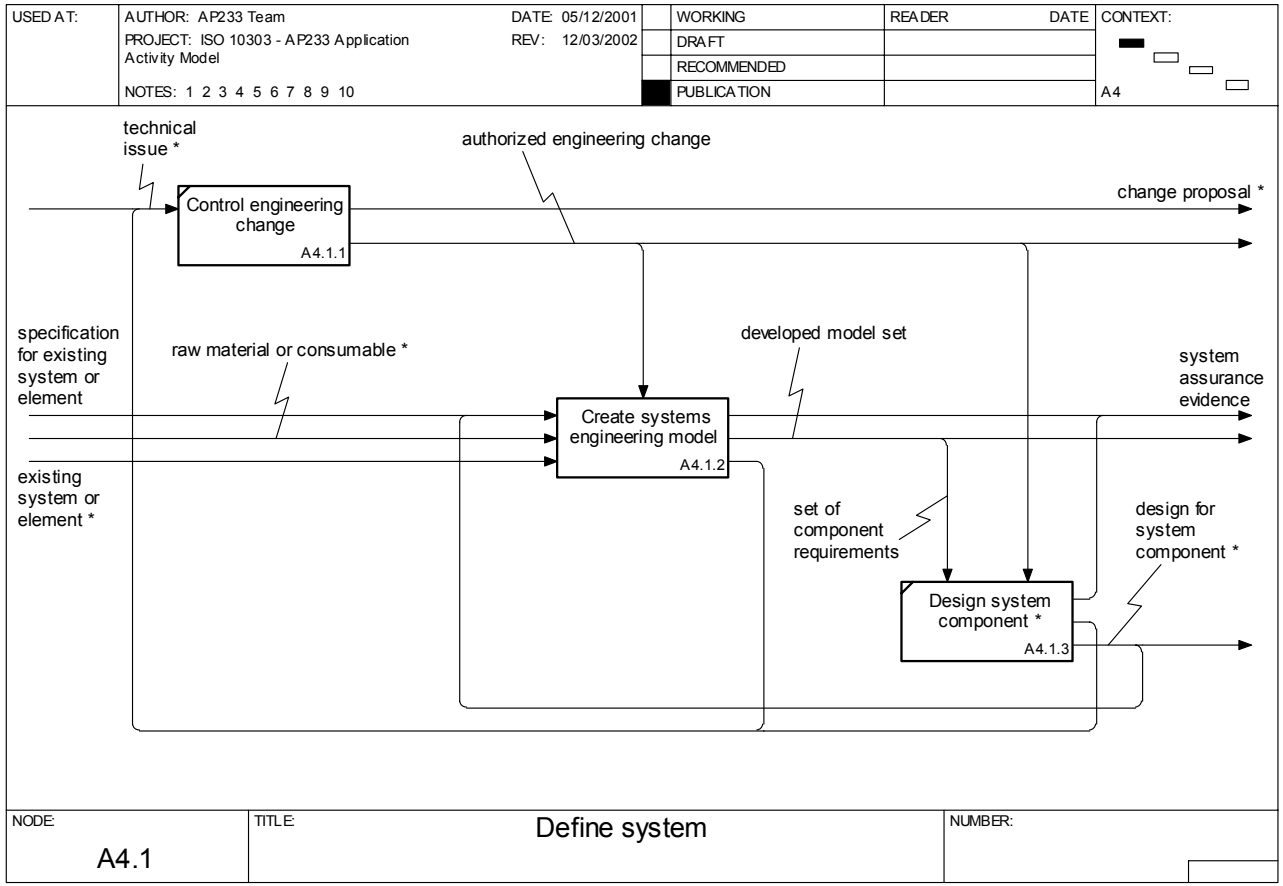

Figure F.5 -- AAM diagram 5 of 11

Control engineering change
Analyze technical impact of discovered issues and generate feedback to initiate project control processes to assess cost, risk and schedule impacts.
Note: "change proposal *" is the basis for activation of "Manage project" to look at non-technical project issues such as cost, risk and schedule.

Create systems engineering model
Develop a model at each tier of the system as the basis for a structured set of specifications.

Design system component *
Create a design specification that provides sufficient detail to enable production and testing of a component.

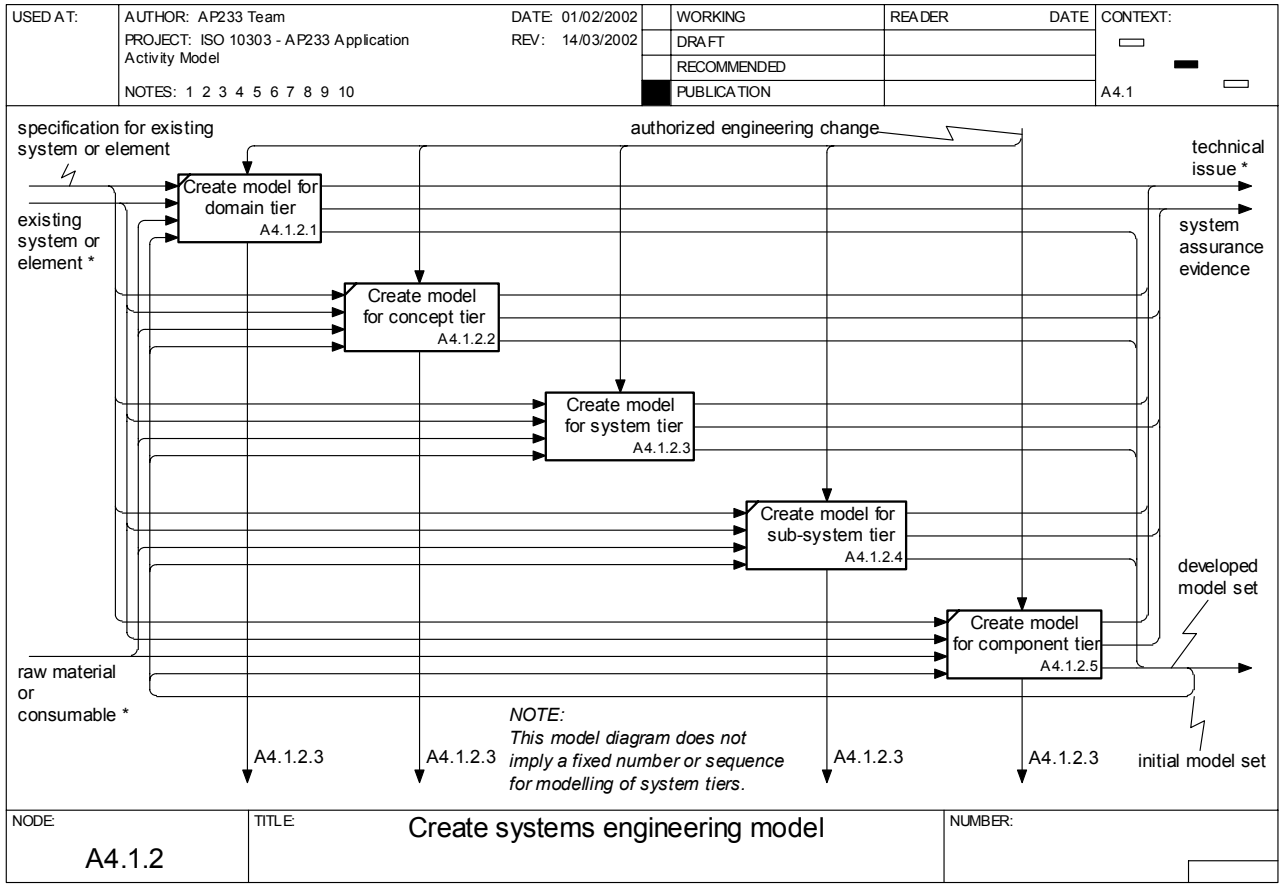

Figure F.6 -- AAM diagram 6 of 11

Create model for domain tier
Perform the generic systems engineering modelling process to generate a specification that can serve across multiple customer organizations in the domain.
Example: This modelling creates a problem description that will possibly result in more than one separately purchased, interacting system, such as in examining the domain of air transport, where aircraft interact with air traffic control systems and airports.

Create model for concept tier
Perform the generic systems engineering modelling process to generate a specification to address requirements in a customer organization.
Note: This modelling creates what is often known as the user or stakeholder requirement (context view) and the system requirement (subject view). These requirements can be in the form of a user requirement document (URD) and a system requirement document (SRD).

Create model for system tier
Perform the generic systems engineering modelling process to provide a specification to address the concept tier model set as a source of requirements.
Note: This modelling creates what is often known as the architectural design.

Create model for sub-system tier
Perform the generic systems engineering modelling process to provide a specification to address requirements from a partition of the system or higher level sub-system tier.

Create model for component tier
Perform the generic systems engineering modelling process to provide a specification to address requirements from an atomic partition of a system or sub-system tier model.

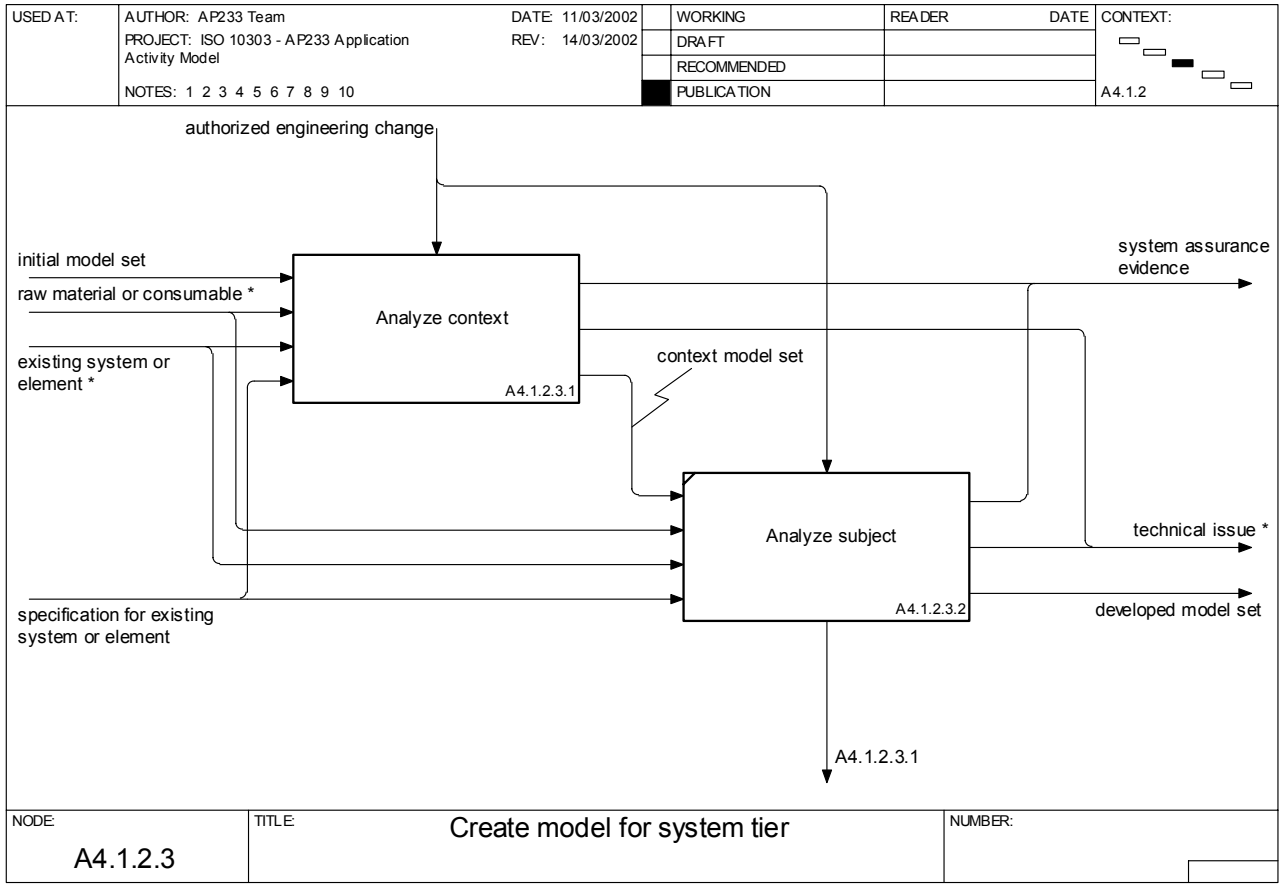

Figure F.7 -- AAM diagram 7 of 11

Analyze context
Perform the generic process to create a model set and, thus, address the context for the subject within the applicable tier of the system.

Analyze subject
Perform the generic process to create a model set and, thus, address the subject within the applicable tier of the system.

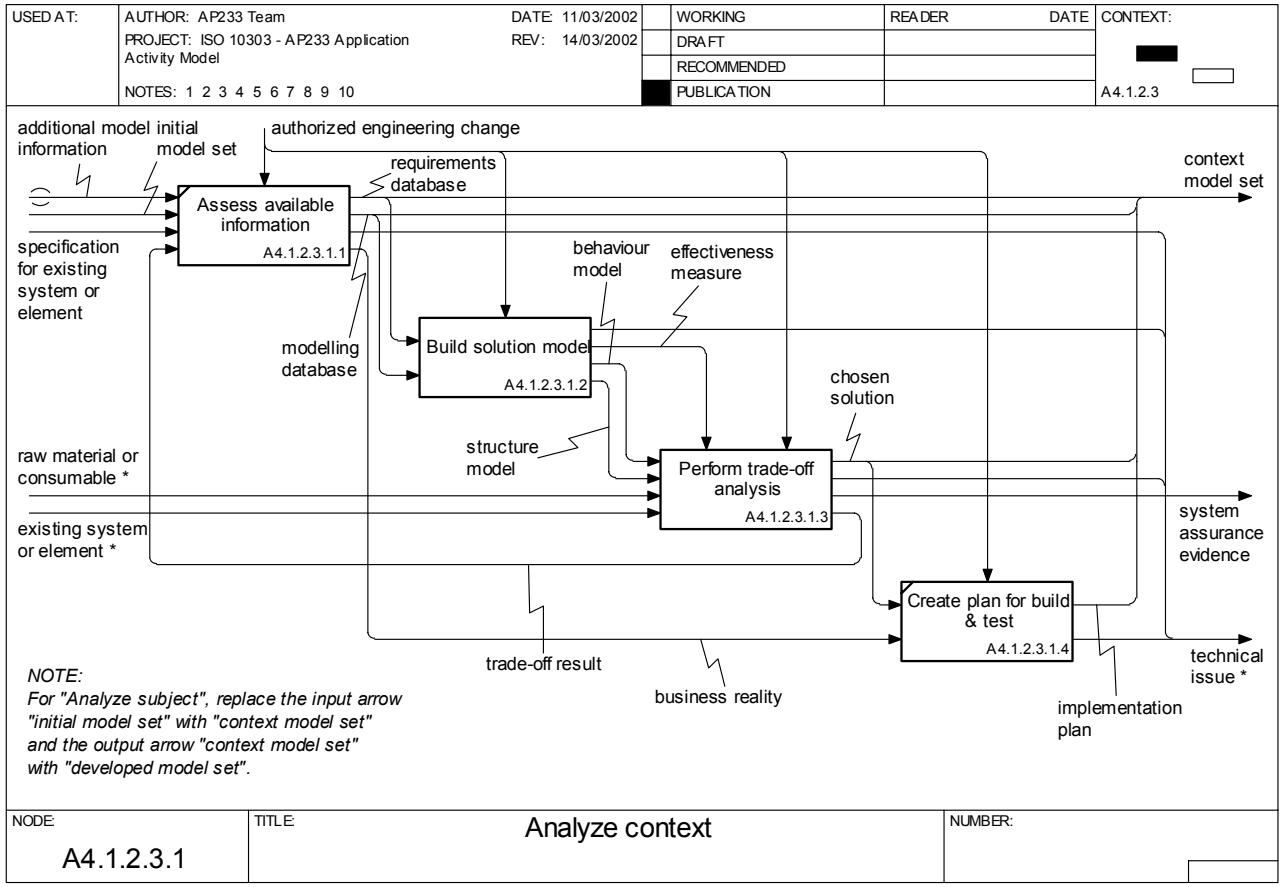

Figure F.8 -- AAM diagram 8 of 11

Assess available information
Prepare foundational information that is necessary for systems engineering modelling.
Note: This information can include: text requirements; heritage information; user information; operations concepts as text; and initial models.

Build solution model
Identify effectiveness measures as the basis for trade-off and create both behaviour and structure models.

Perform trade-off analysis
Choose among alternative solutions within the models.

Create plan for build & test
Address both management of technical issues to establish a schedule that is feasible for production of a solution to the specification models.

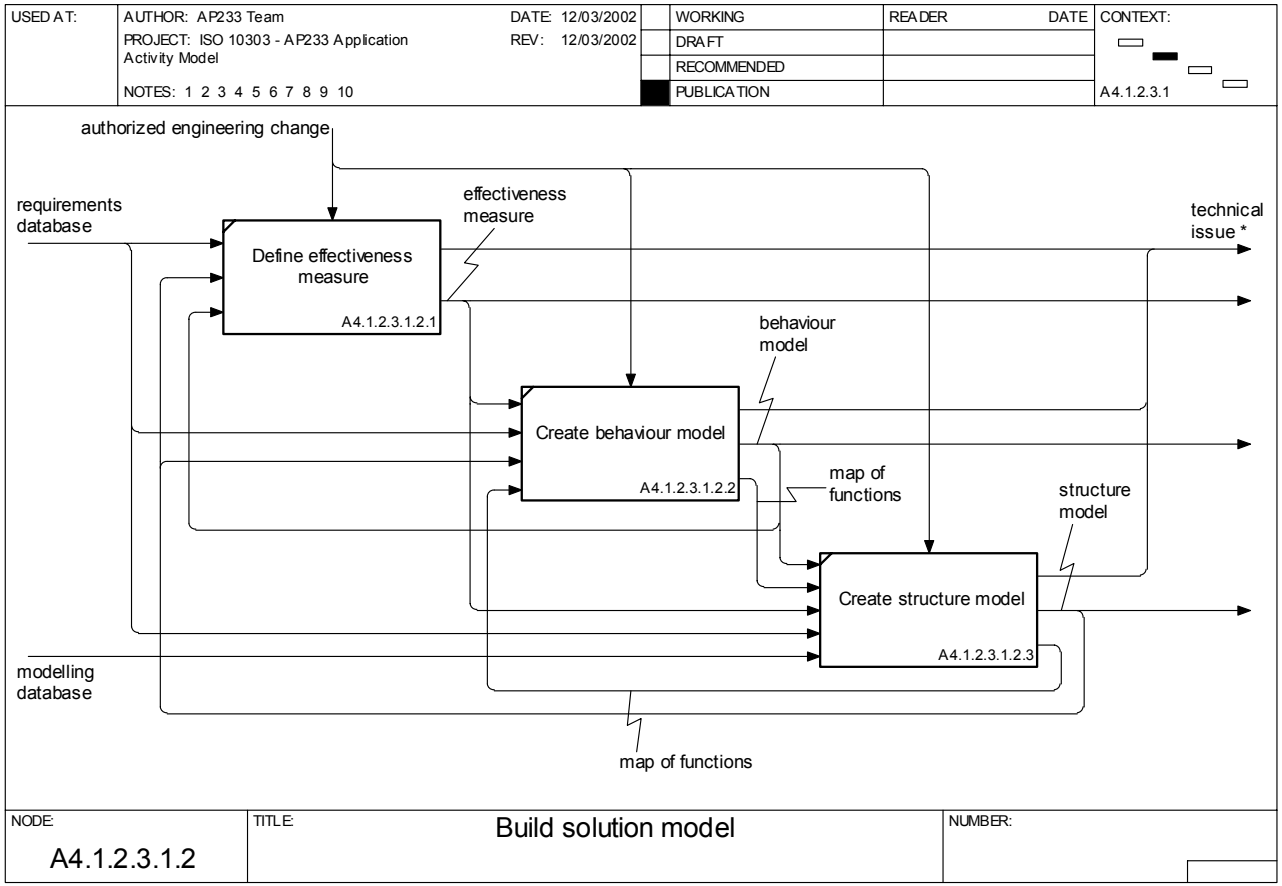

Figure F.9 -- AAM diagram 9 of 11

Define effectiveness measure
Establish the criteria by which alternative model specifications will be judged.

Create behaviour model
Define either the excitations or responses for the subject at the system tier of interest.

Create structure model
Identify the logical and physical composition for the specification.

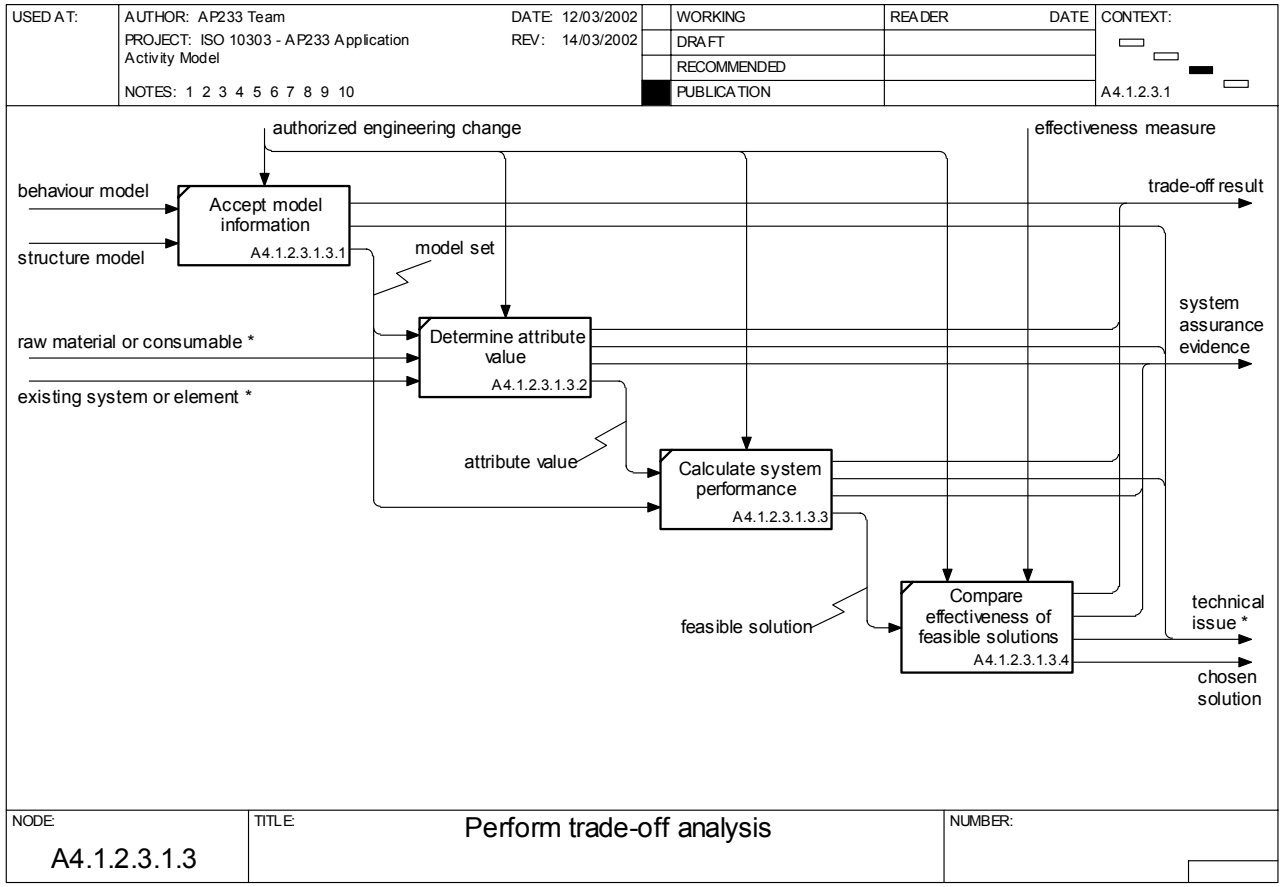

Figure F.10 -- AAM diagram 10 of 11

Accept model information
Confirm the availability and status of all information necessary for conducting trade-off analysis.

Determine attribute value
Obtain value to an applicable level of accuracy for a system attribute that is significant for the trade-off analysis.
Note: This process includes:

- estimation;

- simulation (also known as modelling and simulation);

- measurement from prototypes (requiring the production of suitable prototypes, whether software or hardware).

Calculate system performance
Use obtained attribute values to determine the overall system performance in terms of the applicable set of requirements.

Compare effectiveness of feasible solutions
Rank all feasible solutions on the basis of applicable effectiveness measures and determine the optimum solution.

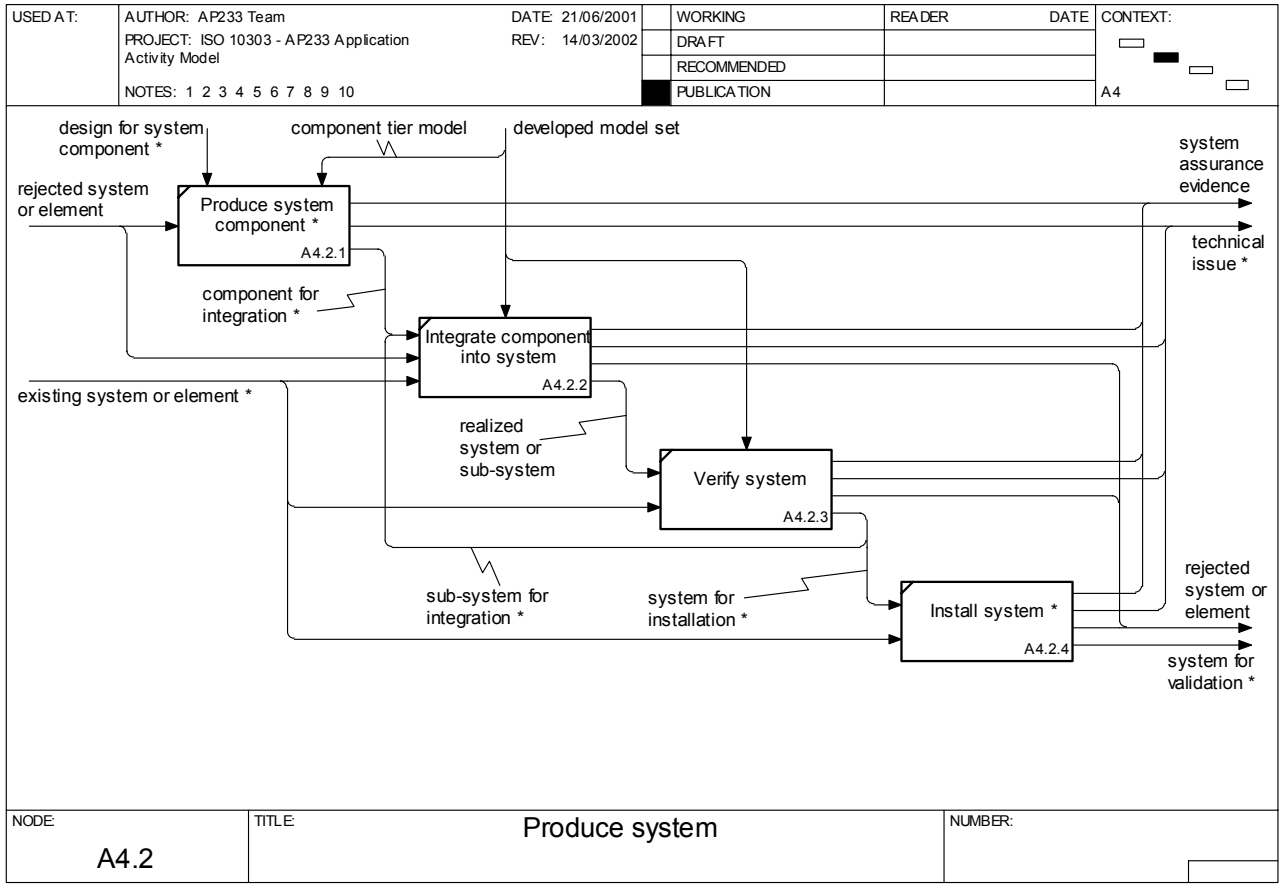

Figure F.11 -- AAM diagram 11 of 11

Produce system component *
Realize and test a component of the system in accordance with the applicable design.

Integrate component into system
Take component and install in the applicable location within the system.

Verify system
Demonstrate that the characteristics and behaviour of a system or system element comply with the applicable architectural design specification.

Install system *
Take verified system and install in operational environment.